HOLISTIC APPROACH TO FOREST FIRE PROTECTION BASED ON SMALL-SCALE BIOENERGY PRODUCTION AND ADVANCED INFORMATION COMMUNICATION TECHNLOGIES

Prof.dr.sc.Darko Stipaničev, Faculty of Electrical Engineering, Mechanical Engineering and Naval Architecture University of Split, Croatia

dr.sc.Branimir Hrastnik, UZOR - Association for Sustainable Development, Bjelovar, Croatia

together with Split and Dalmatia County, Croatia

Split and Dalmatia County Holistic Approach to Forest Fire Protection

- **In 2003 a project has started initiated by Split and Dalmatia County Department for Economy and Development in order to develop a new model of wildfire protection suitable and applicable for Split and Dalmatia County.**

W H Y?

Why ? Because 2003 was one of the most severe wildfire year.

Why we have started Split and Dalmatia County Holistic Programme ?

- Split and Dalmatia County has 256.538 ha of forests land.
- In summer seasons the Split and Dalmatia County is permanently exposed from **a high to a very high fire risks**.

- **In the year 2003, as many as 133 times occurred the wildfire in Split and Dalmatian County**. The total burn down area was **10.028 ha**. The total biomass burned down volume in all littoral areas including islands was 220.000 m^3 of which **125.000 m^3** was in Split and Dalmatian County.

Why we have started Split and Dalmatia County Holistic Programme ?

- The damage of the lost woody biomass in 2003 in Split adn Dalmatia County was assessed at the level of **16 mil.€** for direct damage which includes fire fighting intervention and post fire recuperation.
- The energy equivalent of the 2003 burned down biomass in Split and Dalmatian County was nearly (85%) equal to the value which were needed to cover the present yearly domestic hot water (DHW) demand for 1,5 million of residents in the coastal counties. Presently, more than 90% of the DHW in the littoral area is being prepared by electrical boilers. If we assume the price of electricity in that time, the lost of money equivalent were around **50 mil.€.** so the total damage only in 2003 was **66 mil.€.**
- Ecology damage resulting in erosion are not included in this asssessment.

Why we have started Split and Dalmatia County Holistic Programme ?

- In the same time a lot of money has been invested in forest fire protection.
- According to state enterprise Croatian forest* in the period from 1992 – 2007 the yearly investment in forest fire protection was 114.745.979 kn (more than **15 mil.€.** yearly). The money was spent mostly for establishment and maintenance of fire corridors and roads (66.706.177 kn – almost **8.9 mil.€.** yearly), for wildfire surveillance service (22.622.242 kn – more than **3 mil.€.** yearly) and for forest preservation (18.914.402 kn – more than **2.5 mil.€.** yearly)
- **The question was is it possible to make this investments more effective ?**

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* Dragica Žaja, The role of Croatian Forests d.o.o. in forest fire protection, International Seminar "Wildfire prevention – new methods and principles", Makarska 9-11.XI 2008.

Why we have started Split and Dalmatia County Holistic Programme ?

- Therefore the main goal of our holistic and integral approach to forest fire protection and prevention was to define and propose:

New, self-sustained model for forest fire protectin and protection based on commertial use of biomass, integration with tourism planning and application of advanced Information – Communication Technologies (ICT).

Who has started Holistic Forest Fire Protection Programme ?

The project was initiated by Split and Dalmatia County and Faculty of Electrical Engineering, Mechanical Engineering and Naval Architecture University of Split through study

"Integral model of forest fire protection in Split and Dalmatia County"

What includes Holistic Forest Fire Protection Programme ?

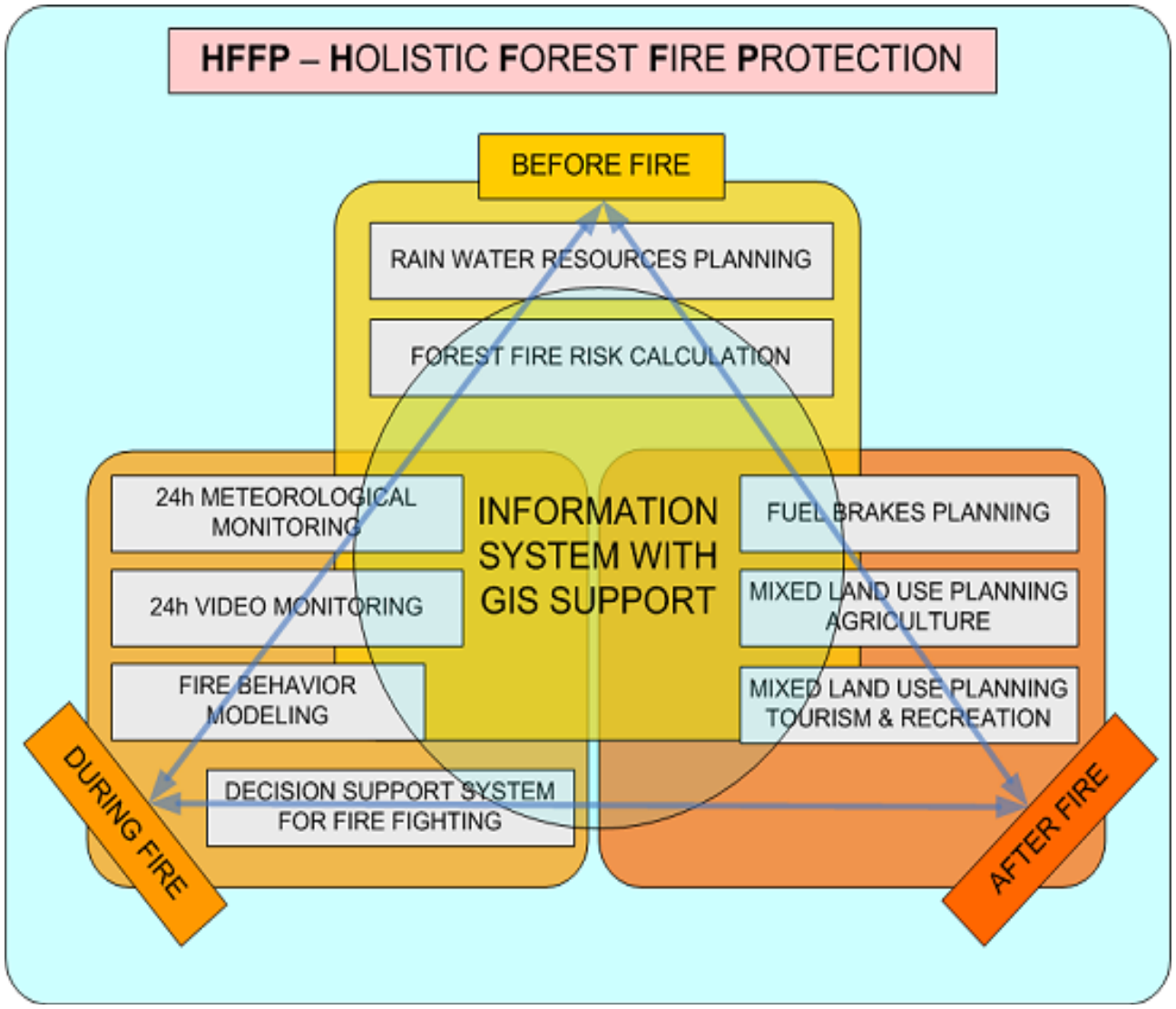
Two main activities concerning forest fire protection are:

- Regular forest thinning and cleaning particularly in high risk areas close to the railway and under the high voltage long transmission lines. Clearing the forest corridors and easy access routes for fire vehicles and fire fighters.

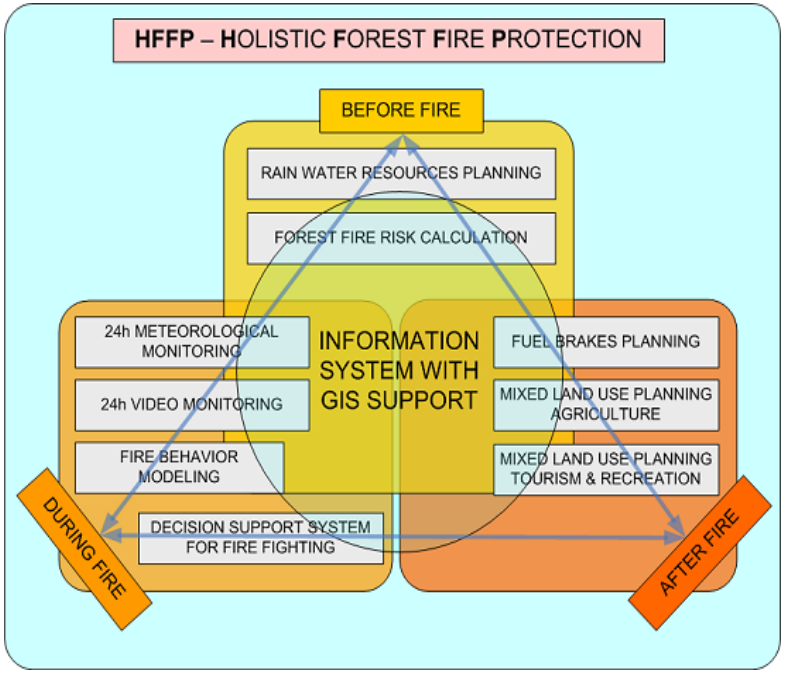
- Establishment of system for forest fire monitoring and early warning based on a field monitoring stations and monitoring patrols (today in most cases realized by human observers).

Therefore our **H**olistic **F**orest **F**ire **P**rotection (**HFFP**) program includes diverse actions connected with these two activities but organized differently and based on advanced Energy and Information – Communication technologies.

What includes Holistic Forest Fire Protection Programme ?



What includes Holistic Forest Fire Protection Programme ?

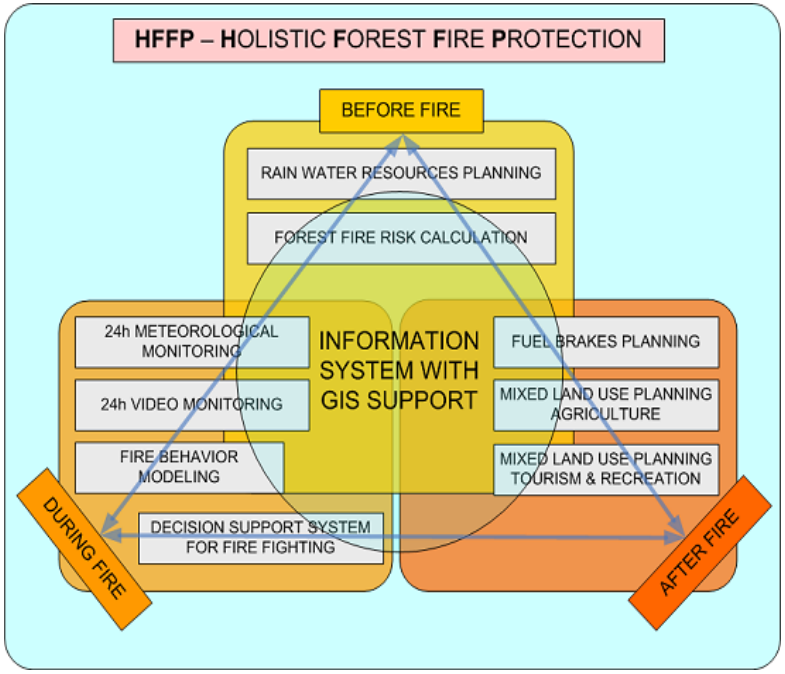


The **H**olistic **F**orest **F**ire **P**rotection (**HFFP**) program Part 1 – Forest Thinning and Clearing connected with advanced Energy Technologies:

•Thinning the forests by cutting and removing densely spaced trees, pruning trees and cutting shrubs to minimize forest fire risk and use them commercially as a biomass fuel in district heating and cooling stations.

•Clearing the forest corridors and easy access routes for fire vehicles and fire fighters, but also creating tourist and recreational roads.

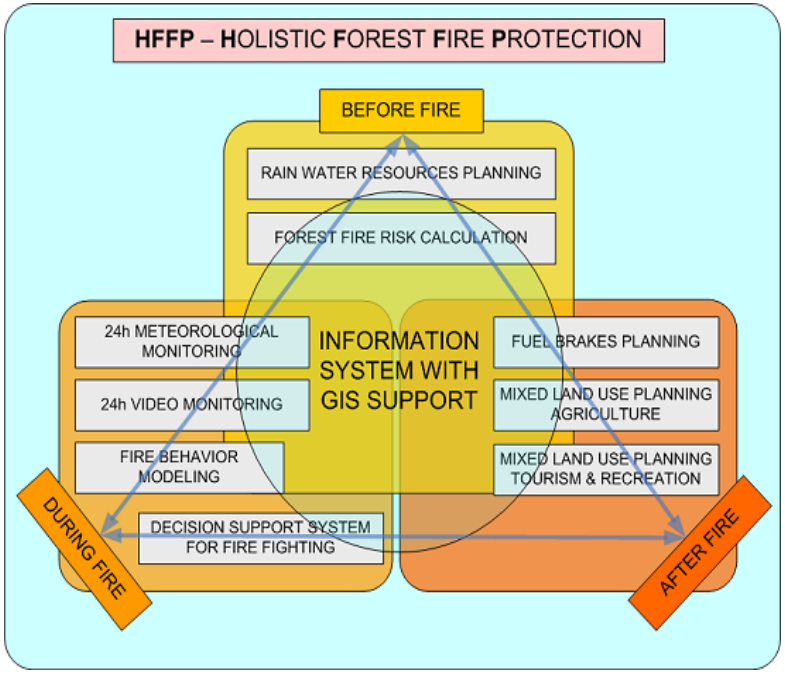
What includes Holistic Forest Fire Protection Programme ?



The **H**olistic **F**orest **F**ire **P**rotection (**HFFP**) program Part II – Forest fire monitoring and management based on advanced Information and Communication Technologies:

- 24-hour automatic video monitoring based on video cameras sensitive in visible spectra and near infra-red spectra.
- 24 hours monitoring of meteorological data.
- Calculating in fire risk index on the level of micro locations.
- Information technology use in forest fire fighting (GIS supported fire management system, fire behavior simulation and modeling.).

What includes Holistic Forest Fire Protection Programme ?



The **H**olistic **F**orest **F**ire **P**rotection (**HFFP**) program Part III – Before Fire and After Fire planning based on advanced Information Technologies and Expert Systems:

- Planning the necessary treatment of vegetation, in order to provide fuel brakes.
- Planning a new kind of “mixed land use” where forestry, cattle-breeding, agriculture, rural tourism, sport and recreation and health tourism motivate the community to take more care on the fire prevention measures.
- Planning the rain-water resources located on the land heights and hills, which is normally used in the agriculture and in case of fire, water is used to feed the extinguishing appliances.

Economic aspect of Holistic Forest Fire Protection Programme ?

- **H**olistic **F**orest **F**ire **P**rotection program was conceived not only to **rise the forest fire protection** on higher level, but also **to create benefits for local economy** and to find appropriate economic approach in order **to assure long term financing of forest fire prevention** activities.
- But let us first analyse a recent situation particularly in Split and Dalmatia County.
- Although the law mandates the maintenance of forest areas it is poorly implemented because the exploitation of forest vegetation types in Split and Dalmatia County (and other parts of the Adriatic region) is not profitable. To be the owner of the forest in Dalmatia is not a benefit, it is primarily a cost.

Economic aspect of Holistic Forest Fire Protection Programme ?

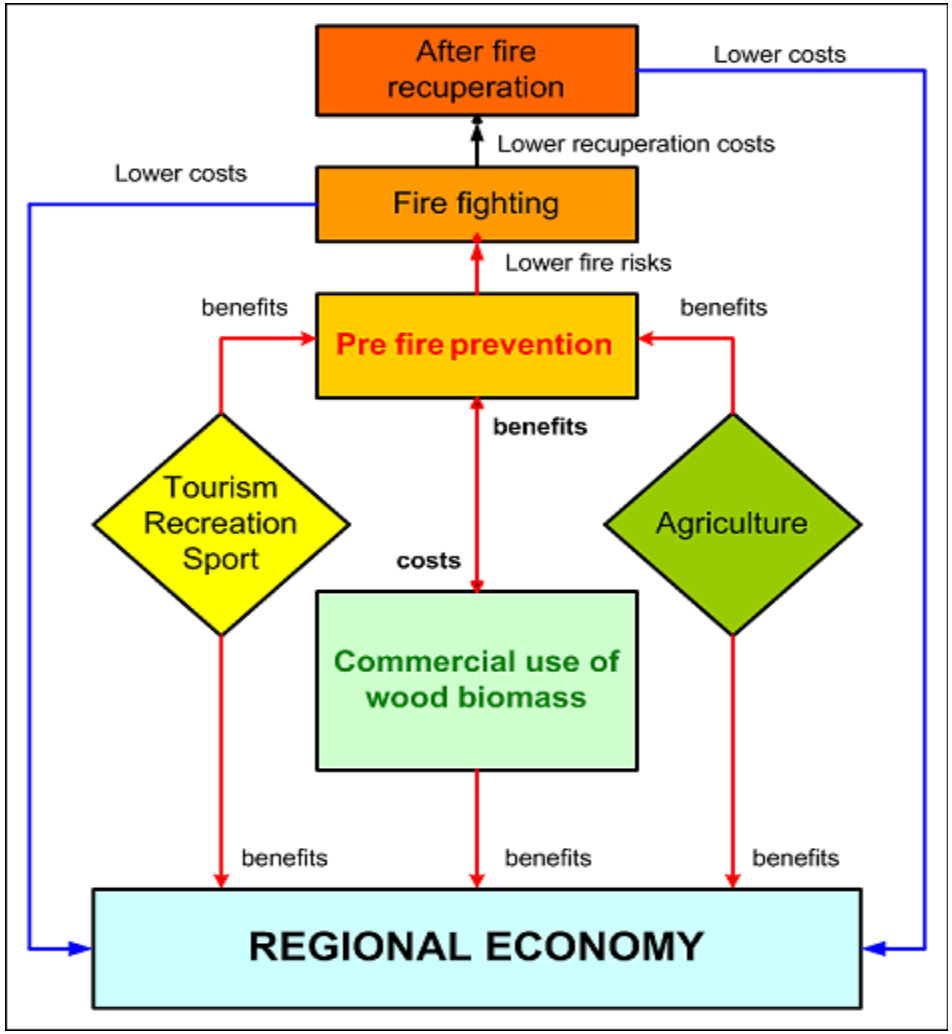
- In Split and Dalmatia County (and in the whole Adriatic region) economic exploitation of forests does not exist, mostly due to vegetation type which is inappropriate for use as a timber but also as a energy sources in classical heating equipment.
- In Split and Dalmatia County (and in the whole Adriatic region) there is no systematic and economic use of forest biomass in any kind of energy production plants.

Economic aspect of Holistic Forest Fire Protection Programme ?

- There are regulations for regular forest thinning and cleaning particularly in high risk areas for example under the high voltage long transmission lines, but they are incomplete resulting in situations like these – the corridor is cleared but the biomass (now even more flammable) is left in corridors, because there are no obligations to collect the slash.

Economic aspect of Holistic Forest Fire Protection Programme ?

- The main clue **H**olistic **F**orest **F**ire **P**rotection **(HFFP)** program is to use the residential population (very extensive) work for **collecting biomass** from the local area and **use it locally in the combined heat and power (CHP) plants**, but also **to use the forest corridors as tourist, recreational and agriculture roads**.



Economic aspect of Holistic Forest Fire Protection Programme ?

- **So instead of situation like this:**

Economic aspect of Holistic Forest Fire Protection Programme ?

- **Let us have the situation like this:**

Economic aspect of Holistic Forest Fire Protection Programme ?

- Do we have economic reasons for that ?
- **YES**
- Preliminary calculations* based on energy prices in 2003 has shown that the total investment in solid biomass CHP plants in Split and Dalmatian County, having in total an estimated thermal capacity of 500 MW_t including transmission and distribution network, are appraised at the order of 600 mill.€ and it could be paid back in a time period estimated in the range of 6-8 years. Todays energy prices are even higher but the main benefits are in reducing wildfire risk.

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* B. Hrastnik; D. Stipaničev, R. Vujčić, Forest Fire Protection by 24h Monitoring, Wood Collection Intended for District Heating Plants and Easy Access Routes Assigned to Firemen and Tourism, **2nd World Conference on Biomass for Energy, Industry and Climate Protection ETA-Florence, Italy and WIP-Munich, Germany , 2004.. V3.36.**

Inforamtion System supporting HFFP programme

- **HFFP** programe also includes appropriate information system support. All forest fire activities are planned to be supported by integral information system based on three type of data:
  - real time meteorological data,
  - real time video data and
  - GIS data.
- The system was conceived as a Cloud Computing or Web Information System (WIS).

Inforamtion System supporting HFFP programme

In application layer the most important modules are:

BF - Before Fire

1.1. Support for Evaluation of the Set of Prevention Planning Measures

1.2. Automatic Early Forest Fire Detection

1.3. Fire Risk Prediction

2. DF - During Fire

2.1. Planning Actions in Fighting Fire

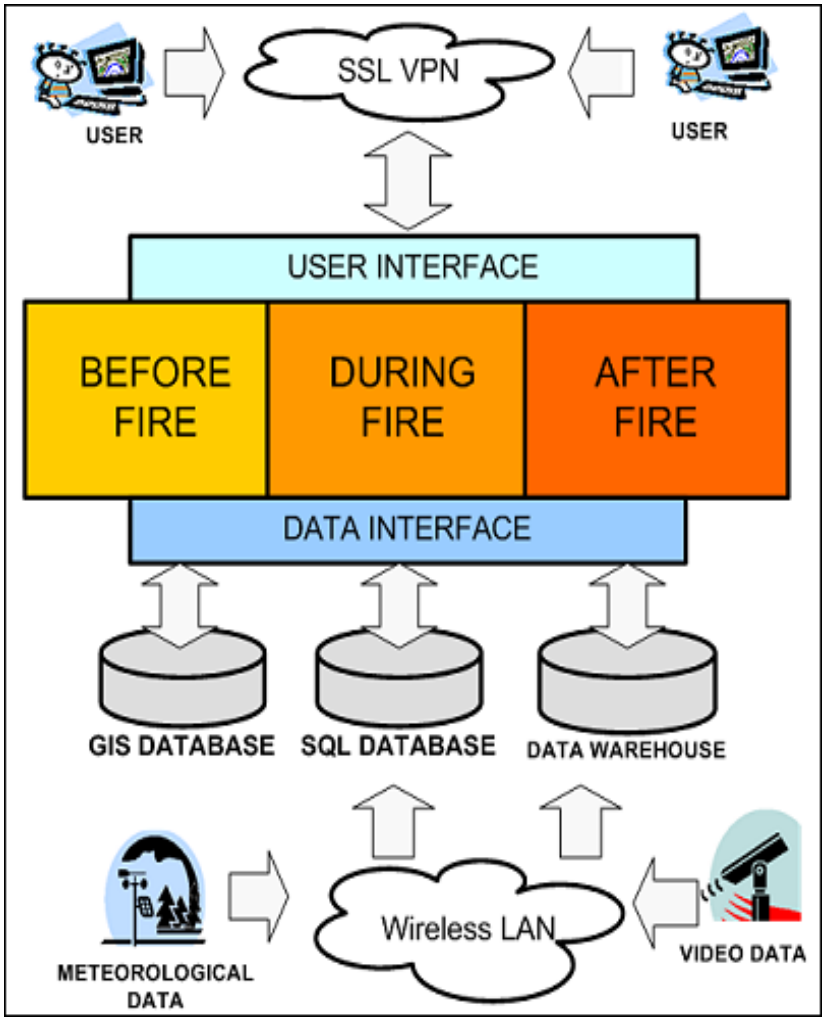
2.2. Distant Video Presence

2.3. Fire Growth Modeling

3. AF - After Fire

3.1. Analysis of the Impact of Fire

3.2. Evaluation of the Set of Measures Necessary for Recuperation.



Actual state of HFFP programme

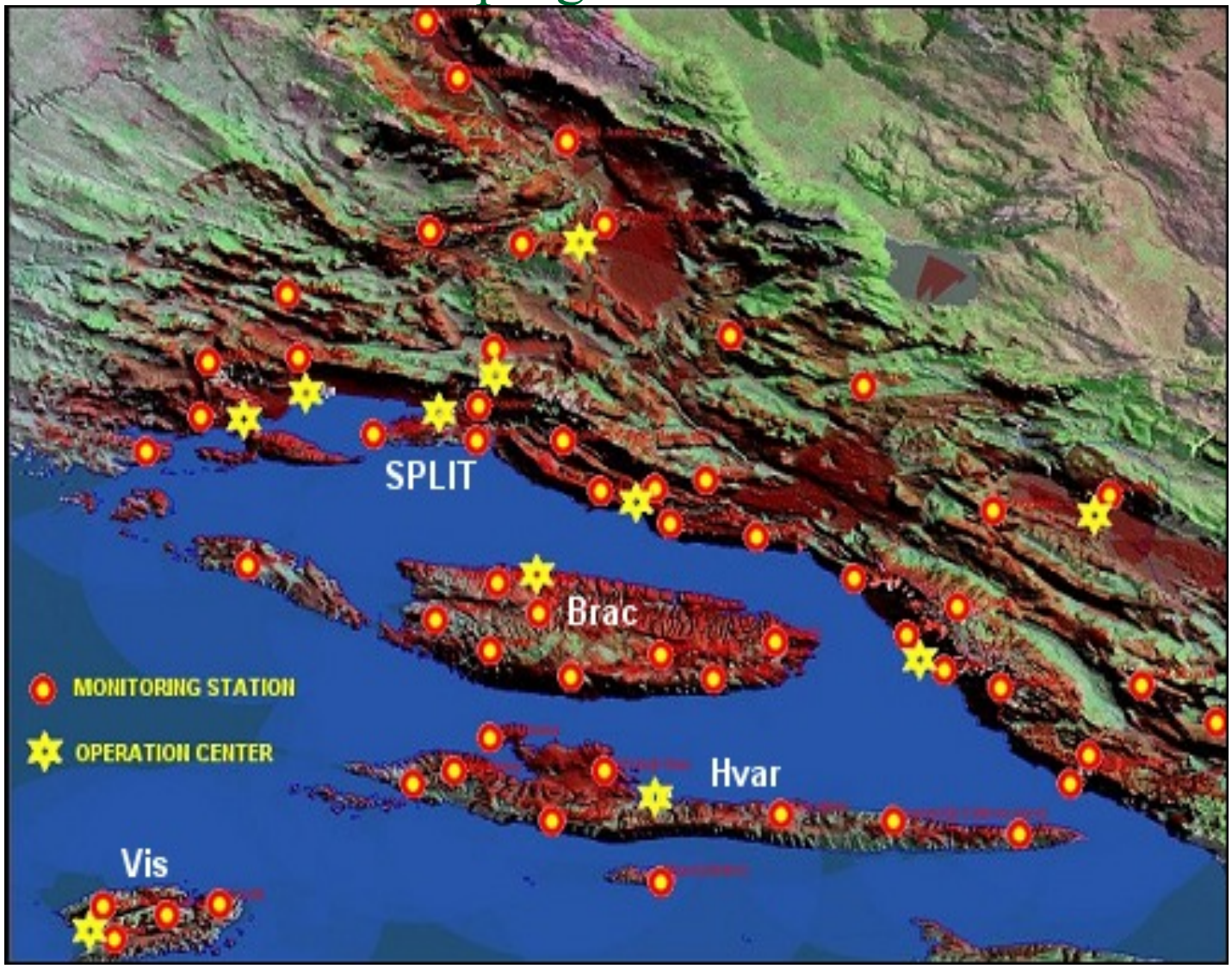
- The Holistic Forest Fire Protection program was presented for the first time in the autumn 2004 and since then we have been working on development of particular project parts, primarily connected with technical and Information communication parts of the program.
- Organizational parts concerning economic use of biomass still need a lot of additional agreements and more political support, so maybe conferences like this one are appropriate places to promote this model of wildfire protection.

Actual state of HFFP programme

- We have been working intensively on two levels:

The first one was design of forest fire automatic monitoring network and the second one was development of certain information system parts particularly connected with fire risk index calculation and wildfire spread simulation.

Actual state of HFFP programme



The project of Split and Dalmatia County forest fire monitoring network consisting of 62 monitoring stations divided in 10 operating zones (dark red color indicate land parts visible from the monitoring stations)

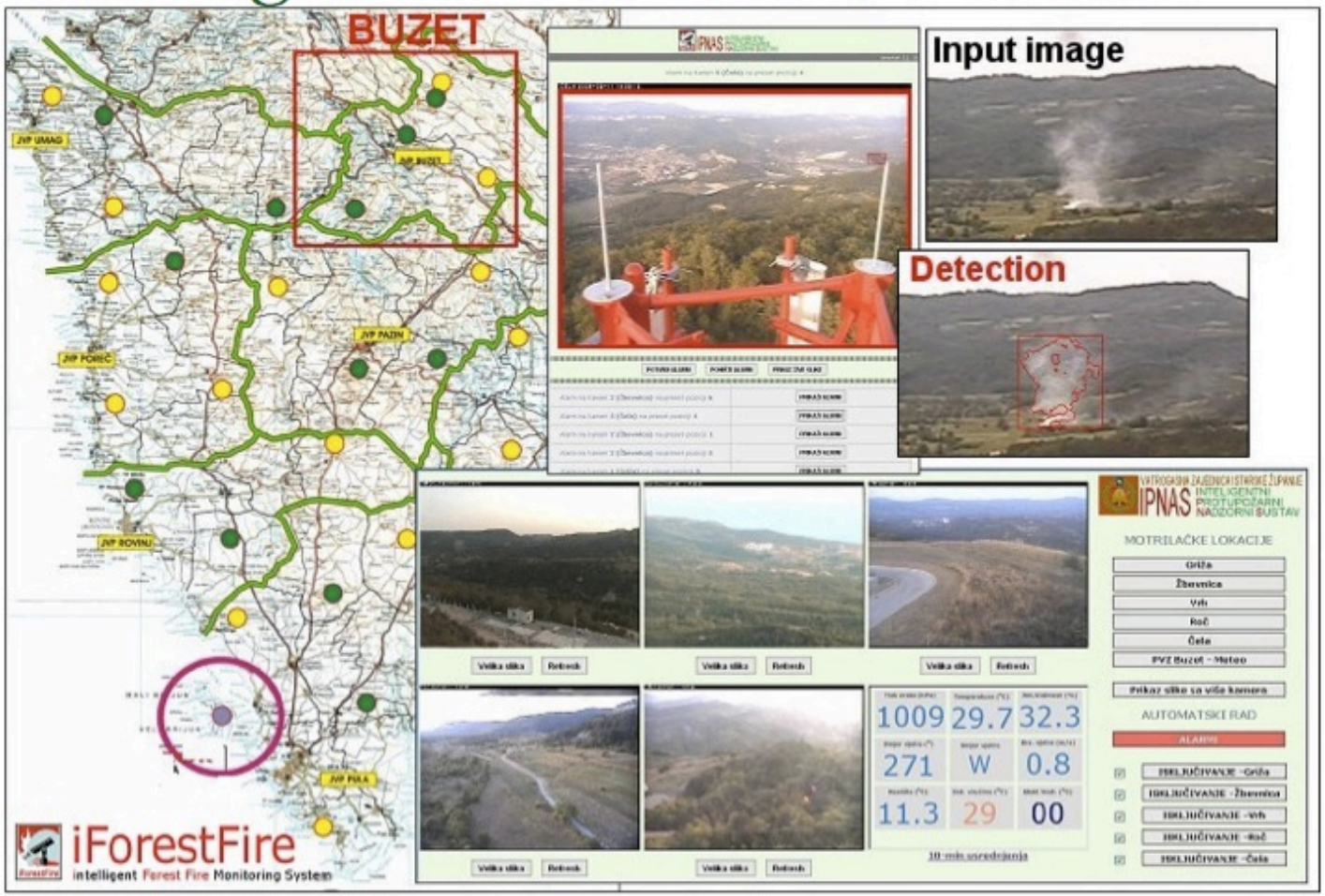
Actual state of HFFP programme

- From this planned monitoring network in this moment unfortunately only one monitoring station was realized in Nature Park Biokovo.

Actual state of HFFP programme

- But in Istra region quite complex wildfire monitoring system is today in function.

Istria region – 29 cameras, 6 centers

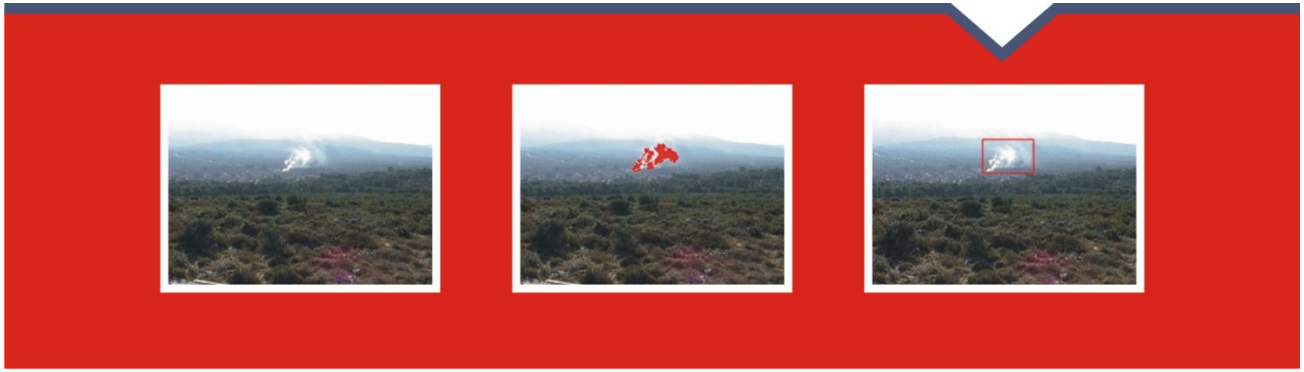


Actual state of HFFP programme

These systems were based on advanced wildfire monitoring system named

iForestFire

Intelligent Forest Fire monitoring system



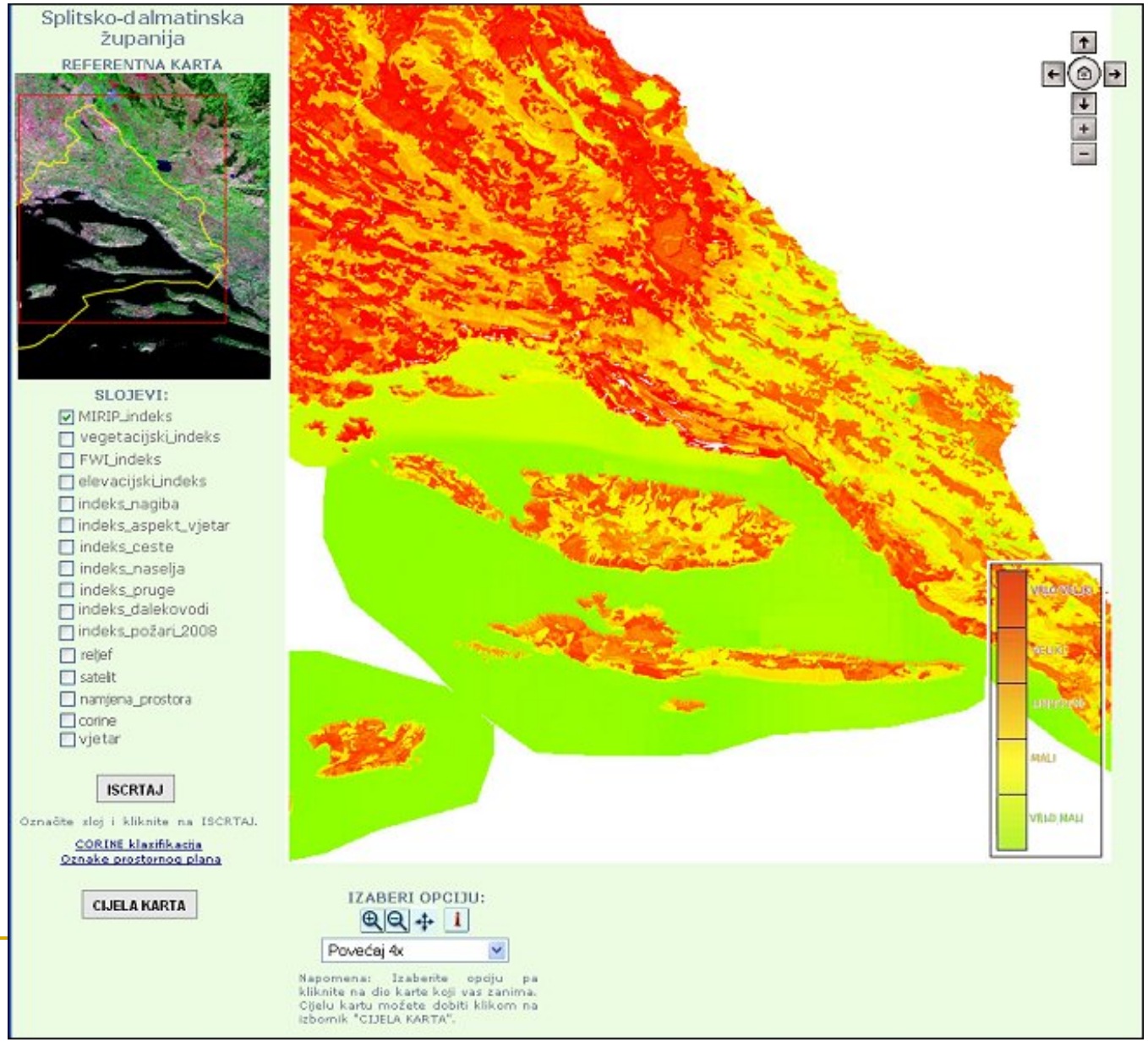
developed at Faculty of Electrical Engineering, Mechanical Engineering and Naval Architecture University of Split, Croatia.

More details on http://iforestfire.fesb.hr

Actual state of HFFP programme

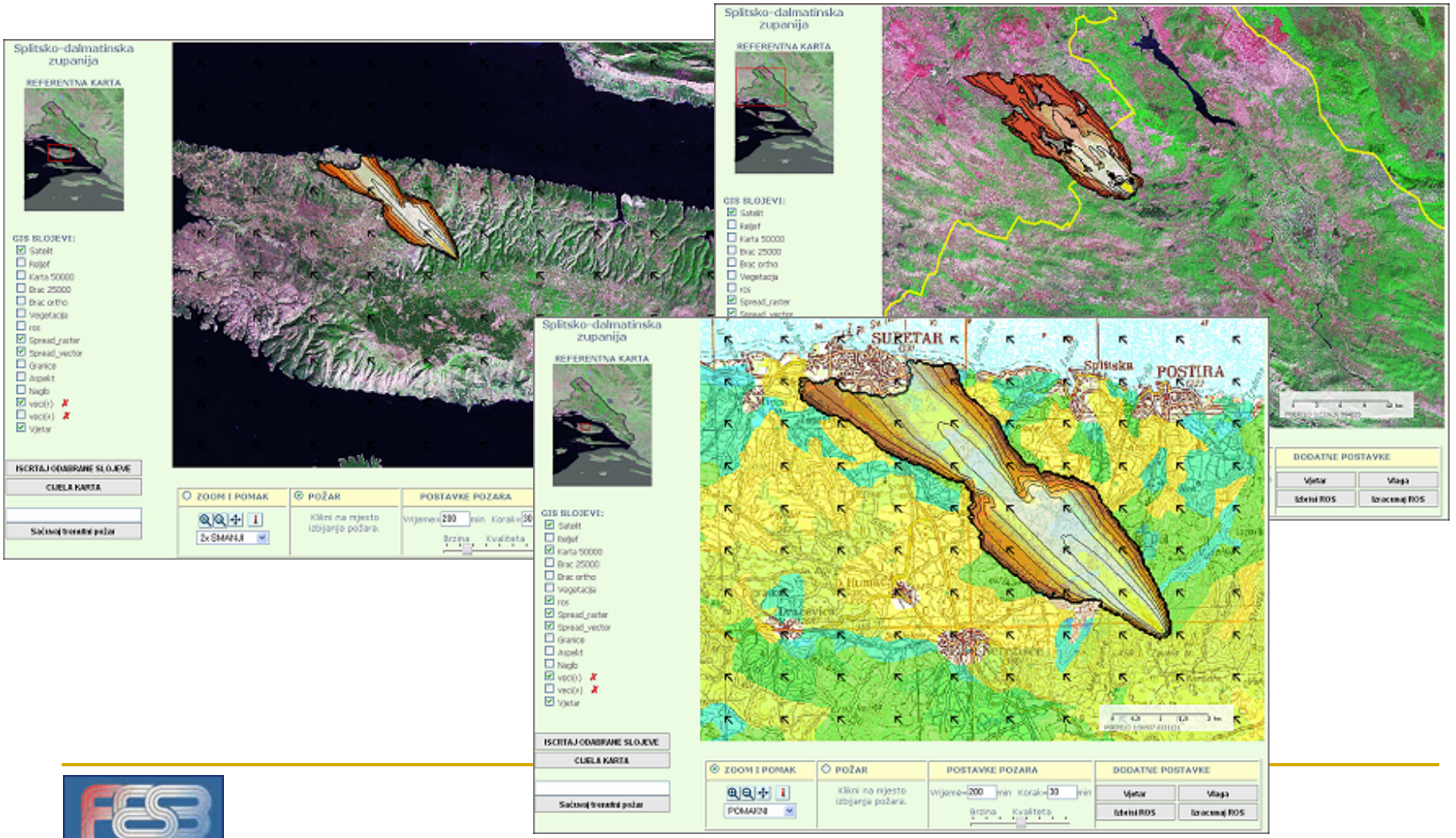
Also an experimental system for micro-location fire risk index calculation was designed named MIRIP in cooperation with Croatian Meteorological and Hydrological Service

(more details on http://vatra.fesb.hr).



Actual state of HFFP programme

As well as an experimental system for wildfire spread simulation named MOOP (more details on http://vatra.fesb.hr).



Actual state of HFFP programme

Finally, in cooperation with Split and Dalmatia County a **Center for Wildfire Research** was established at Faculty of Electrical Engineering, Mechanical Engineering and Naval Architecture University of Split in order to scientifically support all these activates connected with wildfire protection and prevention (more details on http://cipop.fesb.hr).

Future of HFFP programme

- In the future we hope that both missing parts will be implemented. They are:
  - Forest Thinning and Clearing connected with **commercial use of collected biomass fuel** in district heating and cooling stations.
  - Complete realization of advanced Split and Dalmatia County wildfire monitoring network.